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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY  
SECOND SEMESTER M.TECH DEGREE EXAMINATION, MAY 2016

Civil Engineering  
Computer Aided Structural Engineering  
10CE6102 Advanced Metal Structures

Max. Marks : 60

Duration: 3 Hours

Part A (Modules I - II)

(Answer any two questions :  $9 \times 2 = 18$  Marks)

1. a. Explain the different theorems adopted in Plastic Theory (5)  
b. Determine the shape factor of a triangle of breadth 'b' and height 'h' (4)
2. Determine the Plastic Moment of the frame shown in Fig.1 (9)

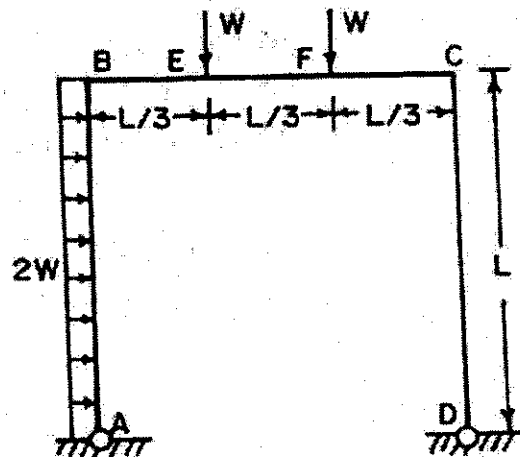


Fig 1

3. Give a detailed expression on the load and reduction factors adopted in LRFD method of design. (9)

### Part B (Modules III - IV)

(Answer any two questions :  $9 \times 2 = 18$  Marks)

4. a. Design a bolted connection between a bracket 8mm thick and flange of ISHB 400 column using HSFG bolts to carry a vertical load of 200 mm from the face of the column. (7)  
b. Explain Prying Action of bolts (2)
5. a. An ISMB 400 is connected to an ISMB 500. The maximum end shear due to factored loads is 180 kN . Design the framed connection. (6)  
b. Write a note on defects in welds. (3)
6. a. Design a welded seat angle connection for an ISHB 300@63 kg/m Column to an ISMB 350@52.4 kg/m beam to transfer a load of 200 kN. (6)  
b. State advantages of welded connection over bolted connection (3)

### Part C (Modules V & VI)

(Answer any two questions :  $12 \times 2 = 24$  Marks)

7. a. Write a note on form factor considered in Light Gauge Compression members. (3)  
b. Determine the allowable load per m run on a beam with the section as shown in Fig 2.

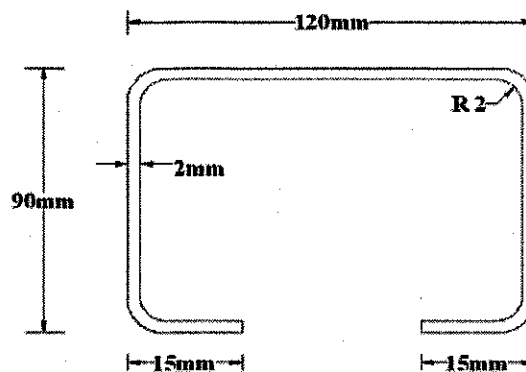


Fig 2.

The effective span of the beam is 3m. Steel has a yield point of  $235 \text{ N/mm}^2$ . (9)

8. a. Enumerate the advantages of Aluminium Structures over steel structures (4)  
b. Explain the design procedure of a Vierendeel girder for covering an industrial buildings (8)
9. a. Write a note on the Portal frames in Industrial Buildings. (6)  
b. Briefly explain the different types of bents in industrial buildings (6)

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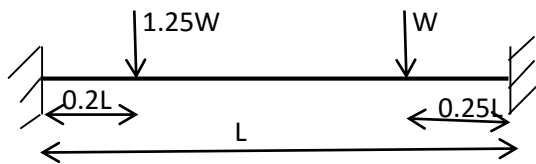
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Duration: 3 Hours

**Part A (Modules I & II)**

*(Answer any two questions:  $9 \times 2 = 18$  Marks)*

1. a) Explain the different theorems of plasticity (6 marks)
- b) Determine the plastic section modulus for a solid circular section, of diameter D. (3 marks)
2. Determine the collapse load for the fixed beam shown in figure (9 marks)



3. What do you mean by LRFD? Explain LRFD with respect to elastic analysis. (9 marks)

**Part B (Modules III & IV)**

*(Answer any two questions:  $9 \times 2 = 18$  Marks)*

4. a) What are the different types of beam connections according to the degree of rotation permitted? (4 marks)
- b) Define Hot spot stress. (5 marks)
5. Design a stiffened seat connection for a MB500, @ 0.869 kN/m beam to transmit an end reaction of 240kN to the flange of a column section HB 250, @ 0.510kN/m. For MB500, @ 0.869 kN/m take width of flange,  $b_f = 180$ mm, thickness of flange,  $t_f = 17.2$ mm, thickness of web,  $t_w = 10.2$ mm and depth upto root of radius,  $h_2 = 37.95$  mm (9 marks)
6. Design a seat angle connection between a beam MB300 and column SC 200 for a reaction of beam 80kN, using M20 bolts of 4.6 class. Take Fe410 grade steel ( $f_y = 250$ ) (9 marks)

**Part C (Modules V & VI)**

*(Answer any two questions: 12 x 2 = 24 Marks)*

7. a) State the advantages of using cold formed structures. (6 marks)  
b) What are the different elements of an industrial building? (6 marks)
8. a) What is a Vierendeel girder? Where is it used? (6 marks)  
b) What are the different types of rigid frame joints? (6 marks)
9. Two channel sections without bent lips 200mm x 150 mm are connected with webs to act as a beam. The thickness of channel is 2.5 mm. the effective span of simply supported beam is 4 m. Determine the maximum uniformly distributed load inclusive of self-weight which can be supported by the beam. The beam is laterally supported throughout its length.

(12 marks)

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**CIVIL ENGINEERING**  
**COMPUTER AIDED STRUCTURAL ENGINEERING**  
**10CE6102: ADVANCED METAL STRUCTURES**

**Use of IS 800, IS 801, IS 811 and Steel Tables are permitted**

Max. Marks: 60

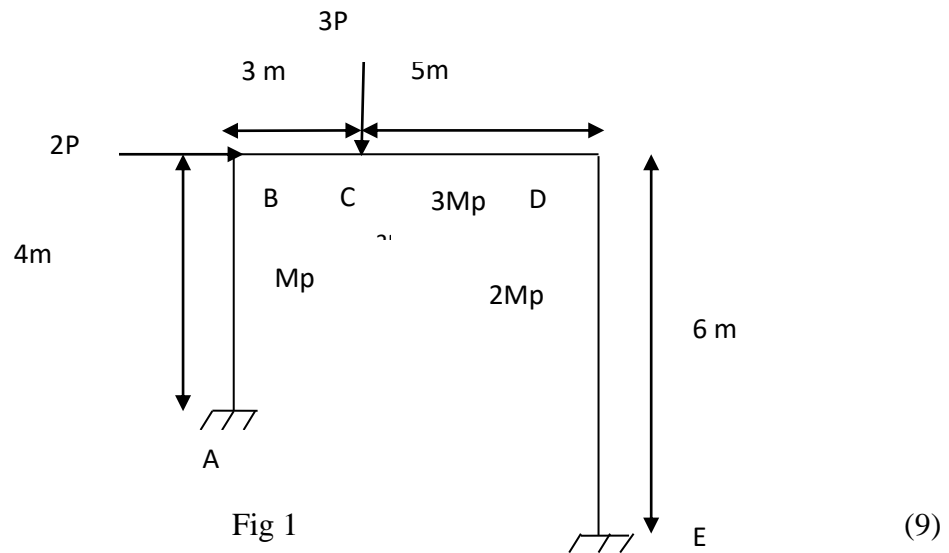
Duration: 3 Hrs

**Part A (Modules I - II)**

*(Answer any two questions: 2 x 9 = 18 Marks)*

1. Define the following terms used in Plastic Analysis with examples
  - (i) Load Factor
  - (ii) Shape Factor
  - (iii) Mechanism

(9)
  
2. Analyse the unsymmetrical portal frame shown in Fig 1 and determine collapse load.



3. Explain the Load Resistance Factor Method of Design introduced by AISC (9)

**Part B (Modules III - IV)**

(Answer any two questions:  $2 \times 9 = 18$  Marks)

4. Explain in detail the analysis and design procedure of Bracket Connection Type-II bolted Connection (9)
5. Design a split beam connection to connect ISLB 600 to a column ISHB 350. The end reaction to be resisted is 150kN and bending moment is 80 kNm. (9)
6. (i) Write a note welds in tubular joints. (4)  
(ii) Write a note on advances in welded connections (5)

**Part C (Modules V & VI)**

(Answer any two questions :  $2 \times 12 = 24$  Marks)

7. (i) Write a note local buckling of thin elements (6)  
(ii) Write a note on unbraced frames in industrial buildings (6)
8. Compute the allowable load on the pinned end light gauge steel strut shown in Fig 2 of 2.4 m length. The column consists of channel section. Take  $f_y=206$  N/mm<sup>2</sup>.  
Question (12)

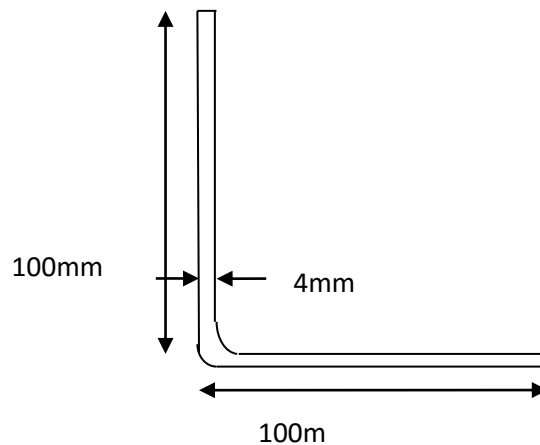


Fig 2

9. (i) Explain in detail the design of Compression members in Aluminum Structures. (8)  
(ii) What are the types of failures in Aluminium Structures? (4)

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**CIVIL ENGINEERING**

Computer Aided Structural Engineering

**10CE6102: ADVANCED METAL STRUCTURES**

**Use of IS 800, IS 801, IS 811 and Steel Tables are permitted**

Max. Marks: 60

Duration: 3 Hrs

**Part A (Modules I - II)**

*(Answer any two questions: 2 x 9 = 18 Marks)*

1. a. Explain the Principle of plastic analysis. 9 Marks  
 b. Write a note on classification of sections. 9 Marks
  
2. Analyse the unsymmetrical portal frame shown in Fig 1 and determine the Plastic moment.

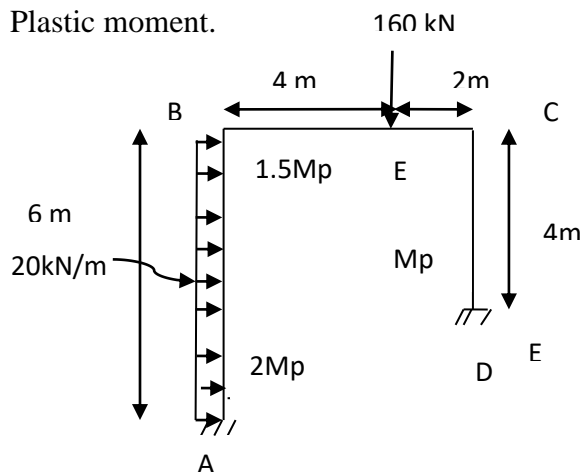


Fig 1

9 Marks

3. Explain the concept of Load Resistance Factor Method of Design in detail. 9 Marks

**Part B (Modules III - IV)**

*(Answer any two questions: 2 x 9 = 18 Marks)*

4. Design a seat angle connection for the factored beam end reaction of 140 kN. The beam is ISMB 300 and column is ISHB 250 using bolt M20 bolts. Steel is of grade FE 410 and bolts are of Grade 4.6. 9 Marks
  
5. a. Explain the design procedure for a stiffened seat angle bolted connection 5 Marks  
 b. Explain the difference in design of Bracket Connection Type I and Type I 4 Marks

6. a. Write a note on the welds in tubular connection. 4 Marks  
 b. Write in detail about the classification of connections based on their rigidity with suitable examples. 5 Marks

**Part C (Modules V & VI)**

*(Answer any two questions : 2 x 12 = 24 Marks)*

7. a. Explain the concept of effective width in light gauge steel sections. 4 Marks  
 b. Compute the allowable load for the following data of the light gauge column of cross section as in Fig 2, of length 3.2m, pinned at both ends. Assume Yield Stress  $f_y=235\text{N/mm}^2$ . 8 Marks

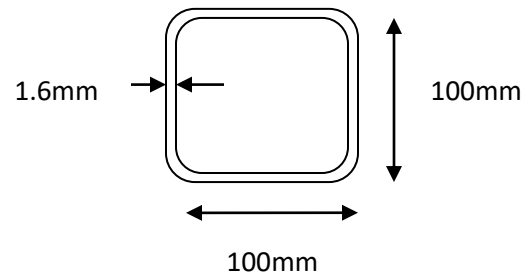


Fig 2

8. a. Explain in detail about Virendeel girders. 6 marks  
 b. Write a note on knee braces. 6 marks
9. Write a Portal Frames in industrial buildings. 8 Marks  
 b. State the advantages of aluminium over steel for structural applications. 4Marks

Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

Pages : 3

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

M.Tech S2 (R,S) Exam July 2021

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Reg. No.....

Name:.....

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY  
SECOND SEMESTER M.TECH DEGREE EXAMINATION

CIVIL ENGINEERING

10CE6102 : ADVANCED METAL STRUCTURES

USE OF IS 800, IS 801, IS 811, IS 8147 AND STEEL TABLES  
ARE PERMITTED

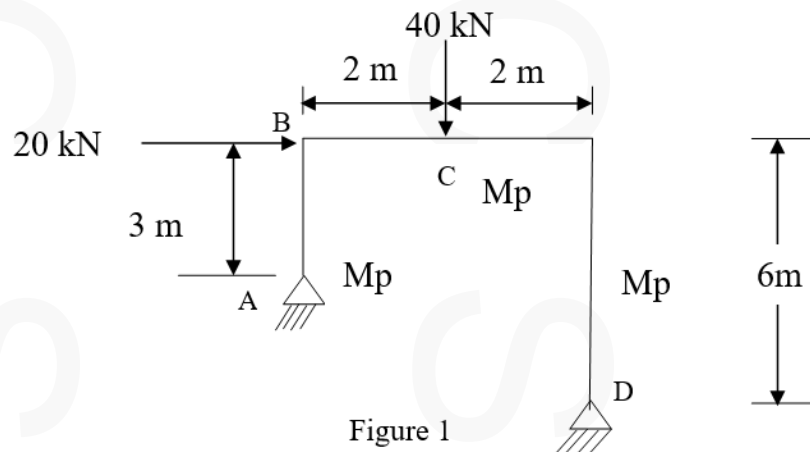
Max. Marks : 60

Duration: 3 Hours

**PART A (Modules I & II)**

Answer any TWO full questions (2 x 9=18 Marks)

- 1 (a) Explain LRFD concept, load and resistance factors with respect to elastic analysis. (6 Marks)
- (b) Derive the shape factor for a square of side 'a' with its diagonal parallel to x-x (horizontal) axis. (3 Marks)
- 2 Find the value of fully plastic moment in the portal frame as shown in figure 1. (9 Marks)



- 3 (a) State and explain the static theorem, kinematic theorem and uniqueness (6 Marks)

theorem of plastic collapse.

- (b) What do you mean by mechanism in a structure? Mention any three types of mechanisms with figures. (3 Marks)

**PART B (Modules III & IV)**

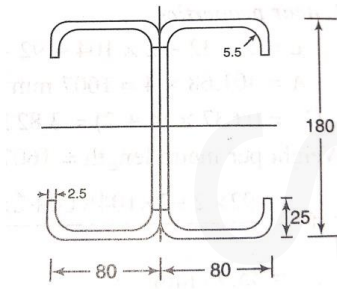
Answer any TWO full questions (2 x 9=18 Marks)

- 4 (a) Explain in detail the analysis and design procedure of Bracket Connection Type-II using bolted connection. (6 Marks)
- (b) What is prying action? (3 Marks)
- 5 A steel beam made of ISMB 250 must be connected to a column flange whose section is ISHB 200. The factored beam end reaction is 110 kN. Design a seat connection for realizing this configuration. The sections used has density 36.6 kg/m and of grade Fe 410. Use bolts with ultimate tensile strength, 400 N/mm<sup>2</sup> and the yield strength, 240 N/mm<sup>2</sup> (9 Marks)
- 6 (a) Define the parameters of an in-plane joint in tubular connections with a neat sketch (4 Marks)
- (b) Write a note on the advance types of welded connections? (3 Marks)
- (c) Write any four advantages of welded connections over bolted connections. (2 Marks)

**PART C (Modules V & VI)**

Answer any TWO full questions (2 x 12=24 Marks)

- 7 (a) Compare and contrast the constitutive relationship between Structural steel and Aluminium alloys along with a plot showing the stress-strain relationships of both the materials. Explain the mathematical representation used for explaining the constitutive relation of Aluminium alloy. (6 Marks)
- (b) Define Stiffened, Multi-stiffened and Unstiffened elements in the context of cold formed steel members with examples. (6 Marks)
- 8 (a) Design a tension member using ALE H30 for carrying axial pull of 70 kN. The angles are connected back-to-back on both sides of a gusset plate using 16mm diameter bolts. (6 Marks)
- (b) Explain the knees and valleys in the steel structures with figures. (6 Marks)
- 9 (a) Two channels of 180 mm x 80 mm section with bent lips as shown in figure 2 are connected with webs to act as beam. The thickness of the plate is 2.5 mm and the depth of the lip is 25mm. The beam has an effective span of 5.5 m. Determine the allowable load per m run on the beam. The dimensions in the figure 2 are in mm. Use  $f_y = 275 \text{ N/mm}^2$ . (9 Marks)



(b) Explain Vierendeel girder with neat sketches. What are its advantages.

(3 Marks)

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